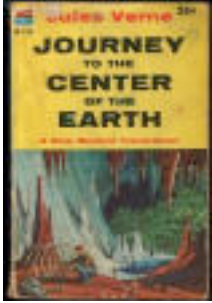


It's All Cracked Up



www.frugalbooks.com/pg/julesverne.html

In the novel *Journey to the Center of the Earth*, Jules Verne wrote of an earth science professor who finds directions to the center of the Earth on a scrap of paper in an old book. The note says that the journey to the center of the Earth is possible. The scrap of paper leads the professor to Iceland, the land of fire and ice. He sets out with his nephew and finds the gateway at an extinct volcano, one that has not erupted in several thousand years. They travel down through a shaft in the extinct volcano to get to the center of the Earth. As they descend, they find great adventure in lost lands and strange creatures. Do you think they were actually able to make it to the center of the Earth? What conditions would you expect them to experience as they descended deeper and deeper into the Earth?

How do we know anything about the middle of the Earth if we can't go there and observe this for ourselves?

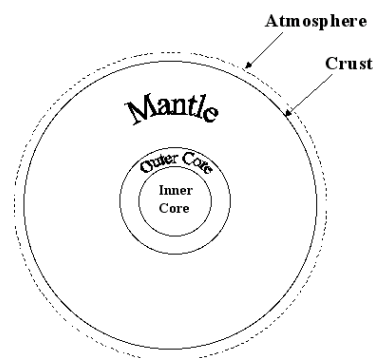
“What’s inside the Earth?” Is one of the hardest questions **geologists** (scientists who study the forces that make and shape planet Earth) have tried to answer. How do we know what is below the thin shell of the Earth when we cannot see it?

Have you ever shaken a wrapped gift to try to guess what was inside? You know that based on the sound it makes; you can narrow down what might be inside the box. When you do this, you are making an **indirect observation**. When geologists want to study the Earth’s interior, they also use an indirect method. But instead of shaking a gift box, geologists use **seismic waves**. Seismic waves are vibrations that travel through Earth carrying the energy released during an earthquake. These vibrations are like what you feels when you shake a box. **Earthquakes** are the shaking and trembling that result from the movement of rock beneath Earth’s surface. The geologists look to see the paths the waves take and how fast they travel through the Earth. Using the data from these waves, they have learned that Earth’s interior is made up of several layers.

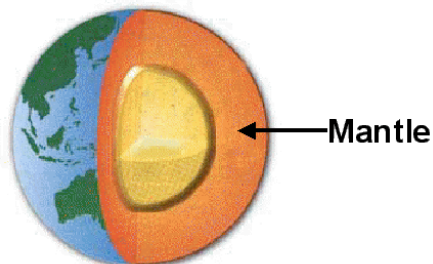
What are the layers of the Earth?

Three main layers make up Earth’s interior: the **crust**, the **mantle**, and the **core**. Each has its own conditions and materials. The **crust** is the layer of rock that forms Earth’s outer shell. This layer is brittle and cool compared to the rest of the earth. The crust is also divided into large pieces called **plates**. The plates are like big puzzle pieces.

The crust varies in thickness from 5 to 75 km (3-47 miles). The thinnest parts of the crust are under the oceans; these are called **oceanic crust**. The thickest parts are the continents, called **continental crust**. The



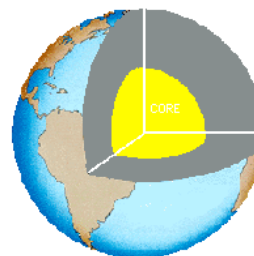
continental crust at the Himalayas is 75 km (47 miles) thick. The rock in the crust is brittle and crumbling, like a piece of cold wax. If you squeeze the wax between your fingers, it will crack and crumble.



www.personal.psu.edu/~users/d/a/dap211/int3.htm

The layer below the cool crust is a layer of hot rock called the **mantle**. The mantle is like wax that has been heated to just below the melting point. Just before the melting point, the rock is able to flow and deform like putty. The mantle is the thickest layer, about 2900 km (1800 miles) thick. The temperature in this thick layer varies from 1600 degrees Fahrenheit at the top to about 4000 degrees Fahrenheit near the bottom. The wide temperature range causes this layer to flow and move. When this layer moves, the crust moves with it.

Below the mantle is the core. It consists of the **outer core** (a layer of molten metal), and inside that, the **inner core**. The inner core is a dense ball of solid metal; extreme pressure squeezes the atoms of iron and nickel so tight that they form a solid and have no room to spread out and become liquid. The energy to move rock in the mantle comes from this hot core.



www.thetech.org/.../quakes/inside/core.html

So what does this have to do with the earth structures we are studying?



http://exploringafrica.matrix.msu.edu/curriculum/lm1/3/students/1_geography.html

The plates float on top of the semi-solid mantle. As the plates move, they cause changes in the Earth's surface. Some of the plates are pulling away from each other, some are pushing toward each other, and some are sliding past each other. The edges of different parts of the crust meet at cracks called **plate boundaries**. Movement at these boundaries can create a mountain, a volcano, a rift valley, an island, or even a deep ocean trench. The plates move at really slow rates. This explains why it has taken millions of years for Earth to look like it does today!



Figure It Out

1. What kind of indirect evidence do geologists use to study the structure of the Earth? Why can't they use direct evidence?